

A Recreational Marine Survey in the Houston-Galveston-Brazoria Area

EPA Emissions Inventory Conference

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Acknowledgements

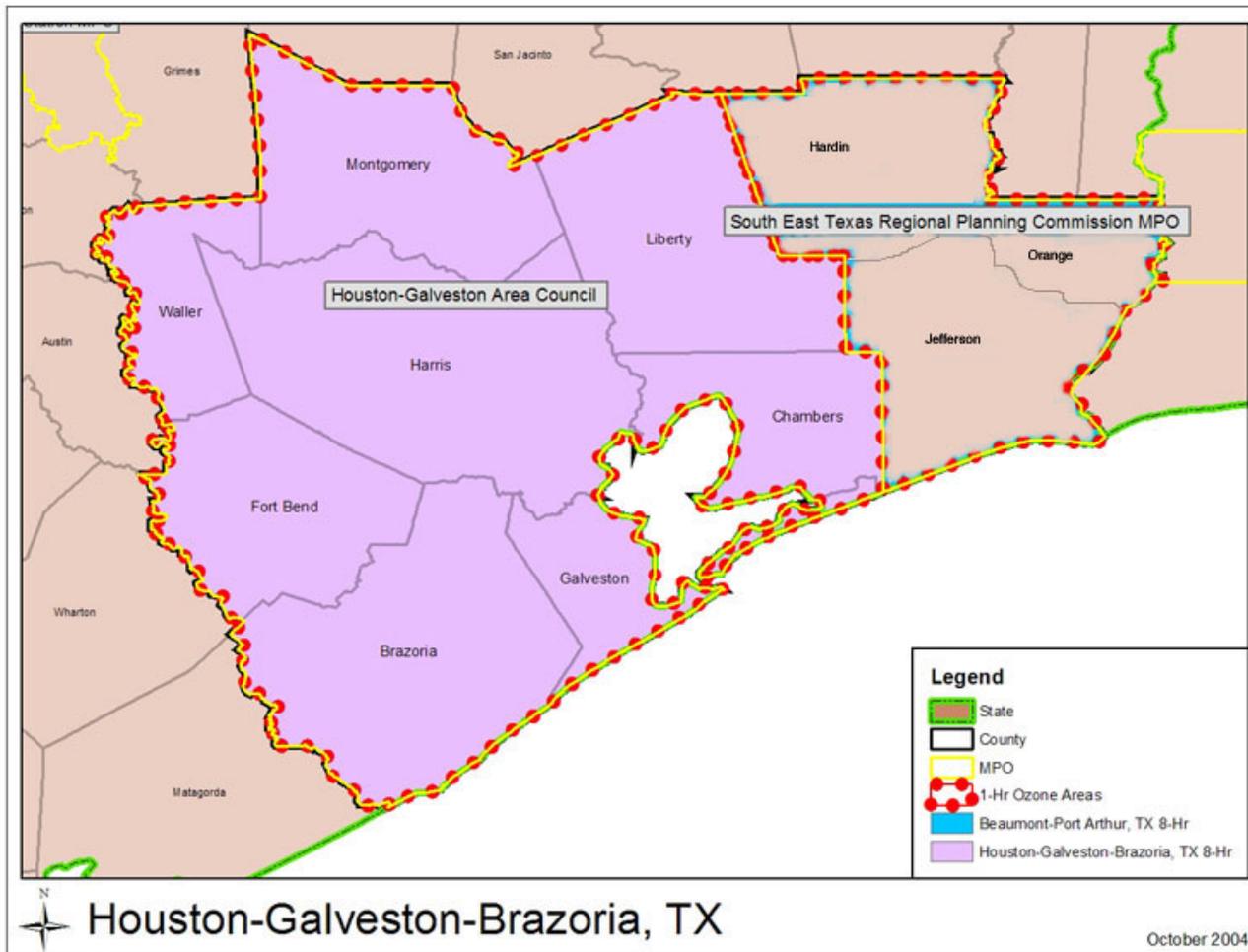
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- Theo Kosub, Texas Commission on
Environmental Quality
- Surveyors: Texas Shoppers Network



Outline

- Houston-Galveston-Brazoria (HGB) overview
- Survey methodology
- Survey results
- Emissions modeling
- Conclusions

Houston-Galveston-Brazoria 8-county area

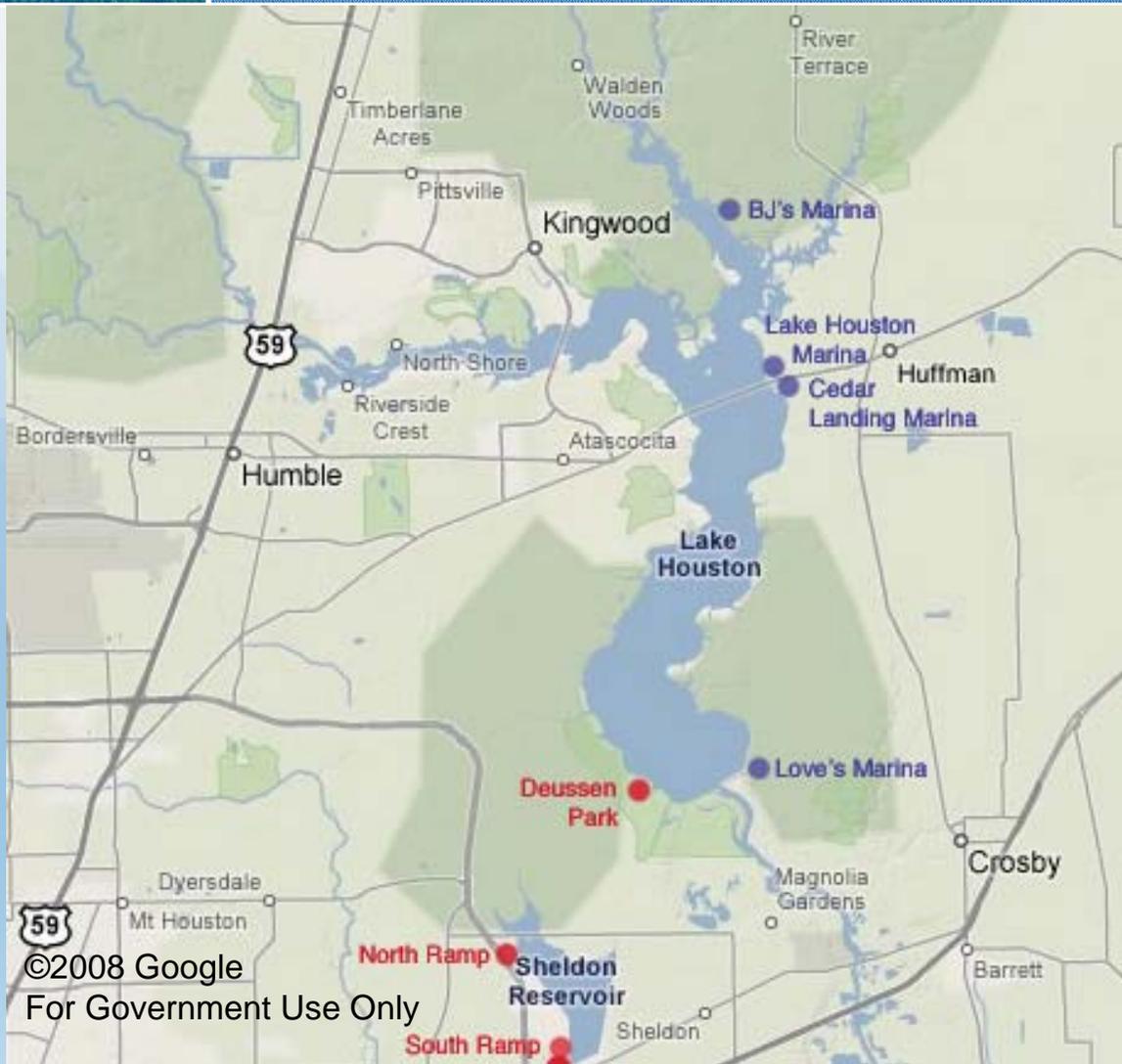


Prepared by FHWA-HEPN-40

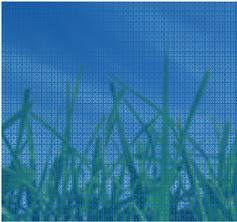
October 2004

- Gulf of Mexico
- Galveston Bay
- Two large lakes
 - Conroe
 - Houston
- Several small lakes and reservoirs

Water Access Points



- 141 Public Access Points
 - 74 Boat ramps (**Red**)
 - 67 Marinas (**Purple**)
- Source:
 - TX State publications
 - BoatUS.com Boat Ramp Locator
- Private docks and marinas not included
- Three counties have no navigable water bodies



Survey Methodology

- 26 water access points surveyed
 - Each point surveyed twice – 1 weekday, 1 weekend day
- Surveyor stationed from 5 am to 9 pm
 - Counted each vessel entering and leaving the water at assigned access point
 - Recorded in boat count log

Boat Count by Type

- Small motorized outboard (fishing, pontoon, or rowboat)



- Sailboat (note visible motors)



- Personal watercraft (also counted those being towed or carried onboard larger boats)



- Large inboard (cruisers, fishing charter boats)



- Small inboard



- Large outboard powerboat



- Not counted: non-motorized, commercial, Coast Guard patrol

Boat Count Log (Sample)

Time of Day		Boat Count by Type								
		A. Small motorized outboard boat	B. Large outboard boat	C. Large inboard boat	D. Small inboard boat	E. Sailboat (please note visible motors)	F. Personal Watercraft	Other	TOTAL	Describe boats designated as "Other"
6 AM	Entering:	III	I			I (motor)			5	
	Leaving:	I							1	

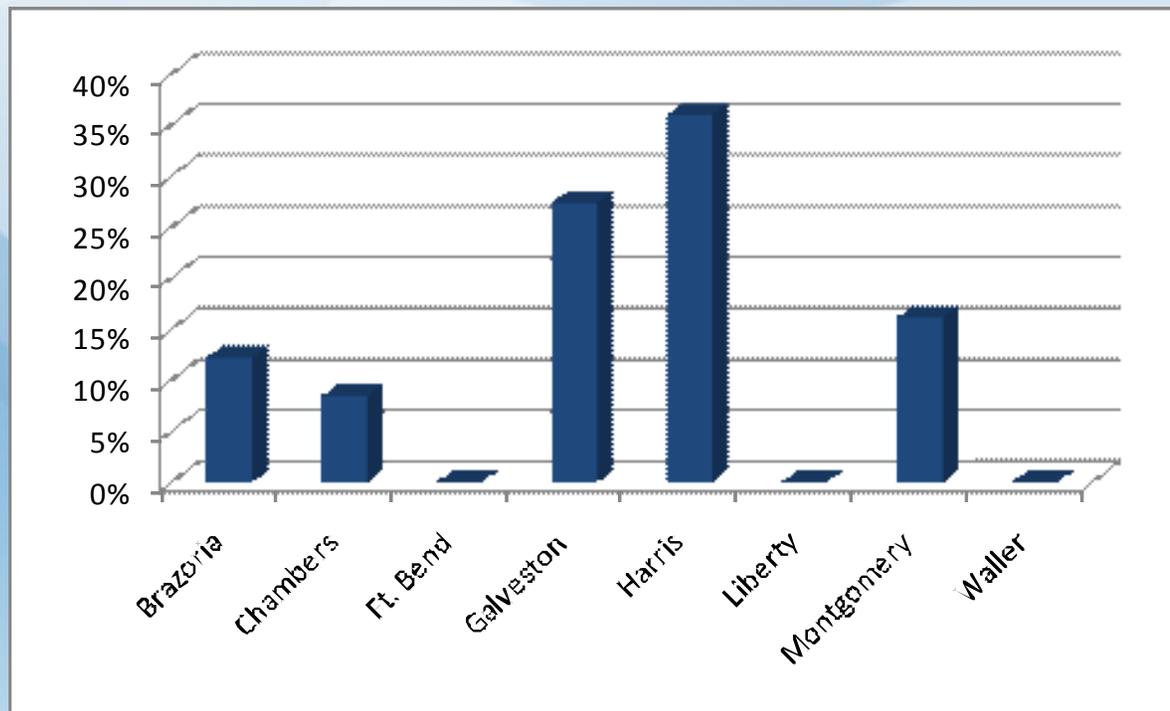


Results

- 52 Boat count logs collected
- The number of boats on the water calculated for each hour of the day
- Activity at each access point attributed to the county where the point is located

County Spatial Distribution of Activity

- The survey site average for each county was multiplied by the total number of water access points to estimate relative activity for the county
- Three counties have no significant bodies of water

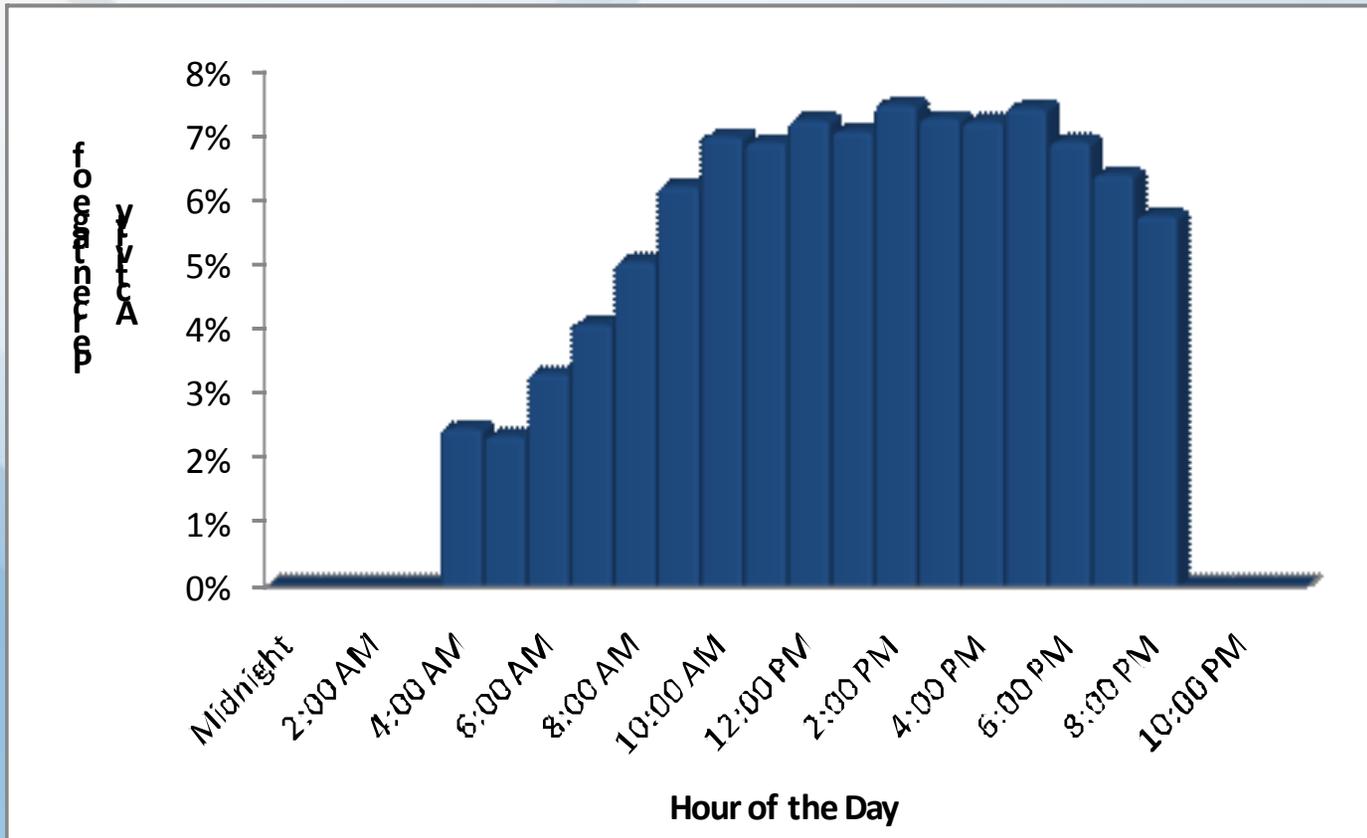


County Weekday/Weekend Distribution of Activity

- The daily total number of boats on the water was divided by the 2-day total to determine the weekday/weekend distribution
- The average 8-county distribution was used for counties with no water

County	Average Weekend Value	Average Weekday Value
Brazoria	2.94	1.00
Chambers	4.94	1.00
Fort Bend	4.31	1.00
Galveston	7.69	1.00
Harris	2.47	1.00
Liberty	4.31	1.00
Montgomery	5.81	1.00
Waller	4.31	1.00
HGB 8-County Area	4.31	1.00

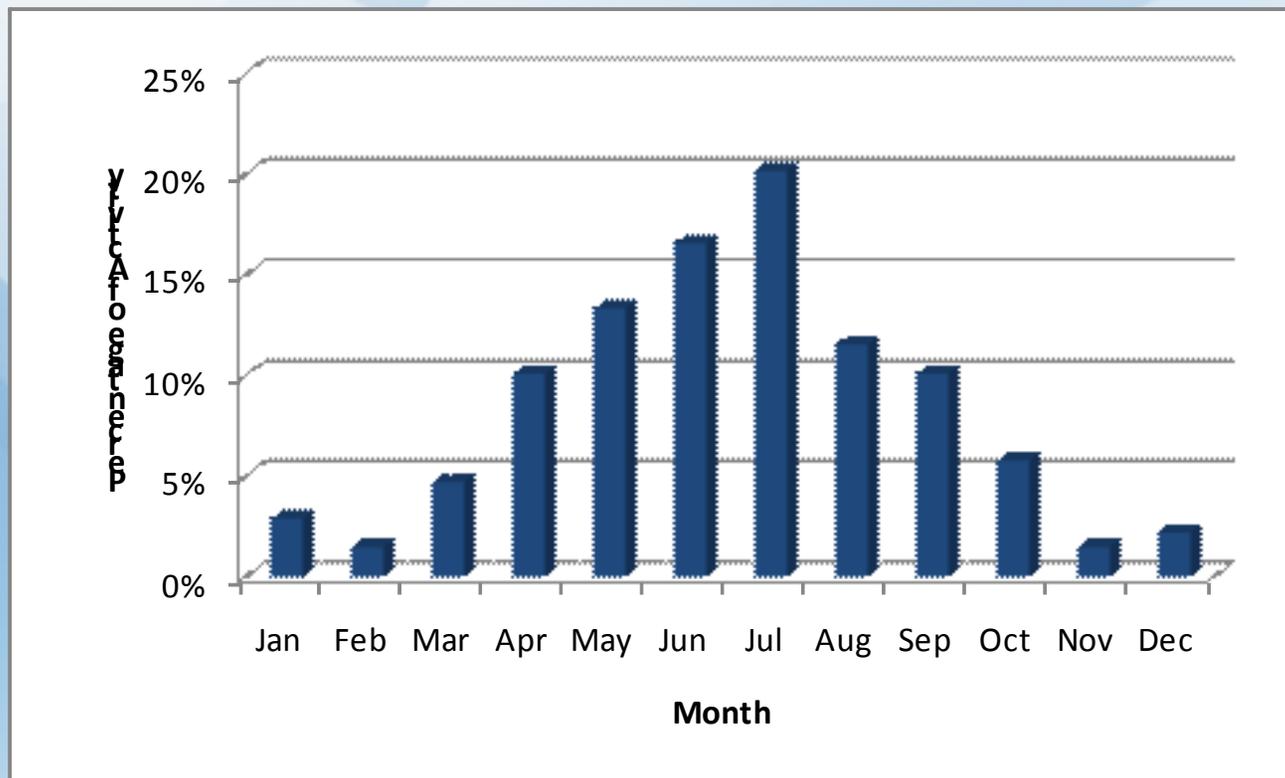
8-County Diurnal Distribution of Activity



- For June-July, Central Daylight Time
- Boating activity from 9 PM to 4 AM was set to zero

Monthly Distribution of Activity

- Boating accidents reported to US Coast Guard serve as a proxy for monthly boating activity





Emissions Modeling

- Updated allocations were incorporated into the Texas NONROAD model (TexN)
 - Spatial by county
 - Weekday/weekend temporal
 - Seasonal temporal
- Boat type distribution from the survey was similar to the defaults in TexN so the defaults were not changed

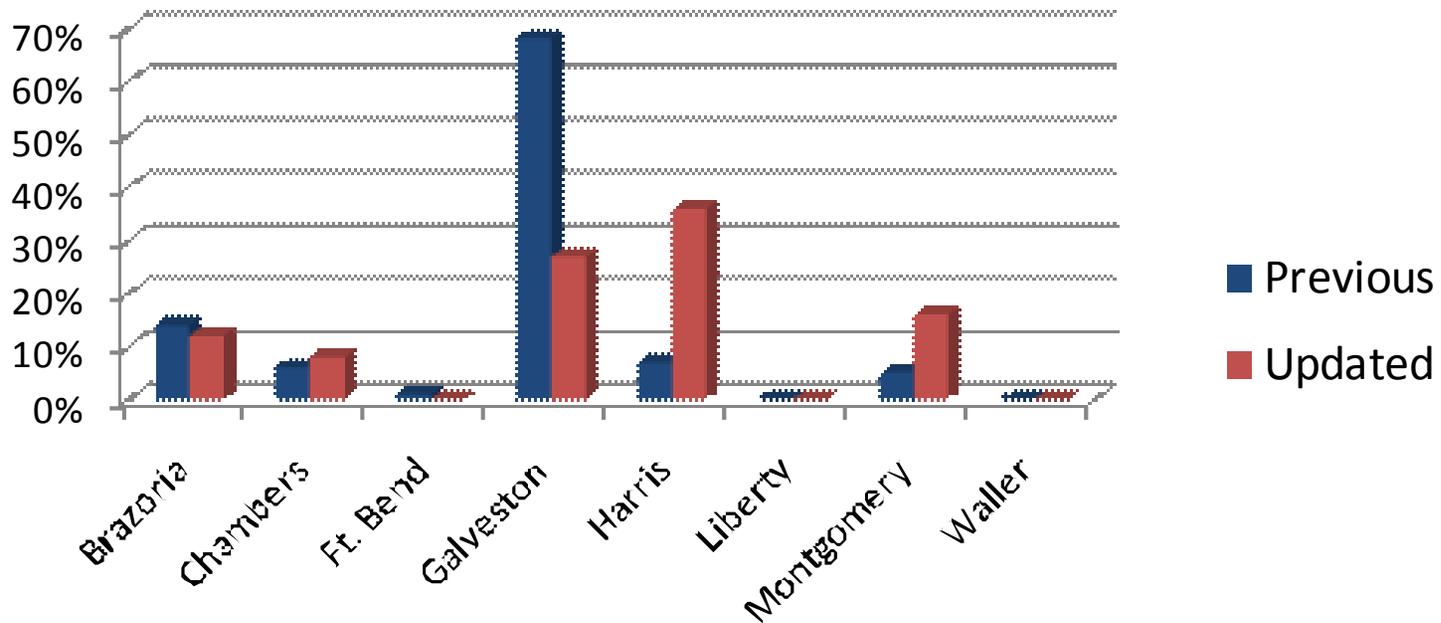
2007 Emissions by County

**Updated 2007 Annual Recreational Marine Emissions by County,
tons per year**

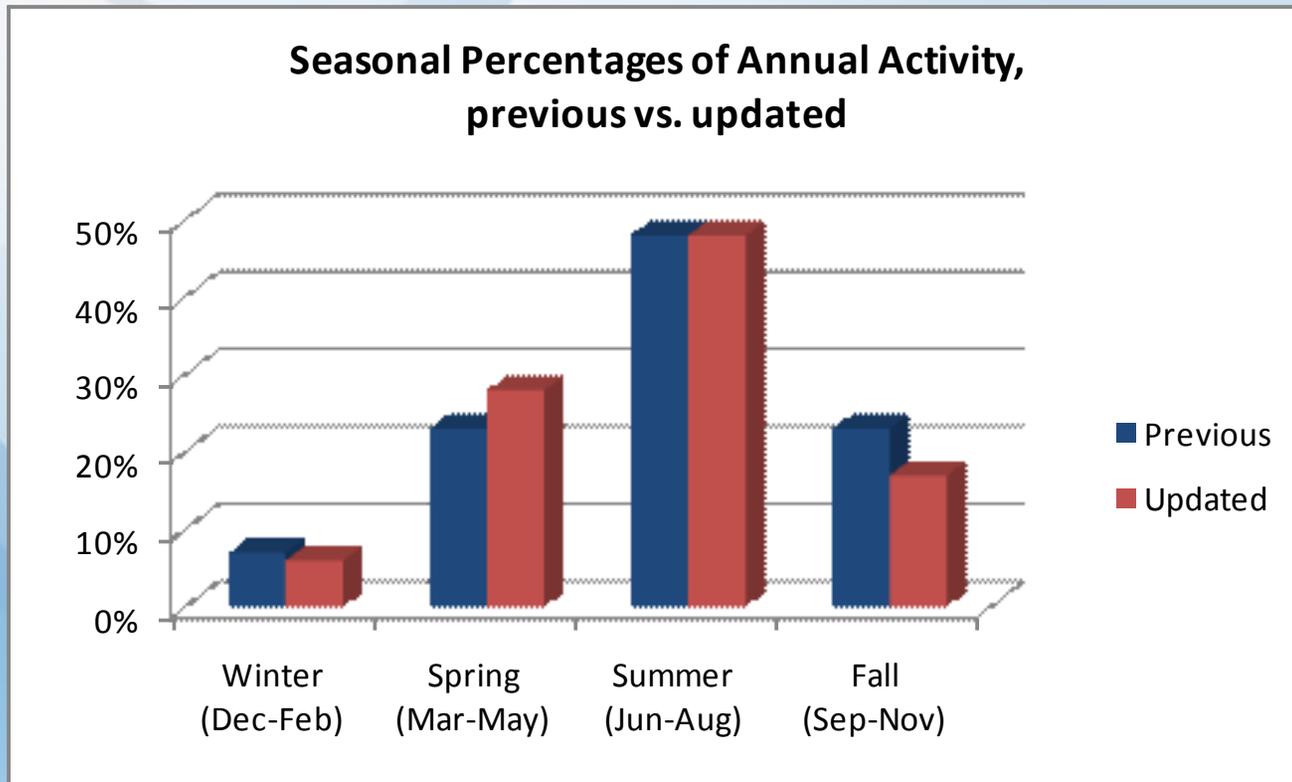
	VOC	NO_x	CO	PM_{2.5}	SO₂	NH₃	% of Total
Brazoria	806.88	65.85	1,862.55	10.94	0.57	0.14	12%
Chambers	550.66	45.38	1,281.79	7.53	0.39	0.10	8
Fort Bend	0	0	0	0	0	0	0
Galveston	1,805.56	147.24	4,167.77	24.48	1.28	0.31	27
Harris	2,380.96	194.16	5,495.95	32.28	1.68	0.41	36
Liberty	0	0	0	0	0	0	0
Montgomery	1,064.80	86.82	2,457.88	14.44	0.75	0.19	16
Waller	0	0	0	0	0	0	0
Total HGB	6,608.86	539.45	15,265.93	89.67	4.68	1.15	100%

2007 Emissions by County

Percentage of Annual Emissions Allocated to Each County, previous vs. updated



Seasonal Emissions Allocation



Ozone Season Weekday Emissions

- Previous, by county, tons per day

	VOC	NO _x	CO
Brazoria	2.38	0.15	4.77
Chambers	1.04	0.07	2.12
Fort Bend	0.11	0.01	0.23
Galveston	11.65	0.74	23.39
Harris	1.14	0.07	2.29
Liberty	0	0	0
Montgomery	0.89	0.06	1.79
Waller	0	0	0
Total HGB	17.22	1.10	34.58

- Updated, by county, tons per day

	VOC	NO _x	CO
Brazoria	1.89	0.11	3.55
Chambers	0.98	0.05	1.47
Fort Bend	0	0	0
Galveston	2.75	0.10	3.21
Harris	6.13	0.39	12.22
Liberty	0	0	0
Montgomery	1.89	0.09	2.76
Waller	0	0	0
Total HGB	13.64	0.74	23.21

Ozone Season Weekday Emissions Trend

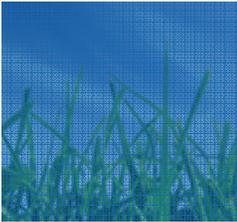
- Recreational marine emissions for HGB area, tons per day

Year	VOC	NO _x	CO
2005	13.94	0.87	18.85
2007	13.64	0.74	23.21
2008	13.41	0.77	22.97
2011	12.82	0.85	22.31



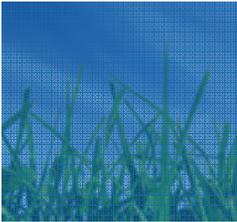
Limitations/Future Recommendations

- Update the TexN model to allow for diurnal allocation inputs.
- Delineate personal watercraft population in TX Parks and Wildlife registration data then use data to update vessel population in TexN.



Limitations/Future Recommendations

- This study did not modify the defaults for total recreational marine activity in TexN. It updated the percentage allocated to HGB. A future statewide survey of recreational marine activity could be used to update total activity.
- Analyze differences between Mon-Thu and Fri activity for ozone episode day modeling.



Conclusions

- Performed field survey to evaluate recreational marine activity in HGB
- Field survey results were used to update spatial and temporal activity allocations
- Updated allocations were used as inputs in the Texas NONROAD model to estimate emissions